Feb, 1972

A PROPOSAL FOR AN UNDERWATER TRAIL IN HANAUMA BAY, OAHU

submitted by students
in the Marine Option
Program at the
University of Hawaii

INTRODUCTION

In 1969 the Governor's Task Force on Oceanography made a recommendation in Hawaii and the Sea proposing that underwater trail markers, marine life identification plaques, static shore displays, and visual aids for visitors be made available in Hanauma Bay.

Some students in the Marine Option Program at the University of Hawaii agreed strongly with the Task Force recommendation. These students, interested in acquiring more knowledge about the ocean, are now working with the State in helping to accomplish these goals.

By talking to various State officials, including Mr. Joe Souza and Mr. Bill Gorst of the State Department of Land and Natural Resources and Mr. Henry Sakuda of the Department of Fish and Game, students learned that the State was interested in acquiring more information concerning many facets of the project as a whole. The students in the Marine Option Program then volunteered to accumulate information and make suggestions which could prove useful.

OBJECTIVES

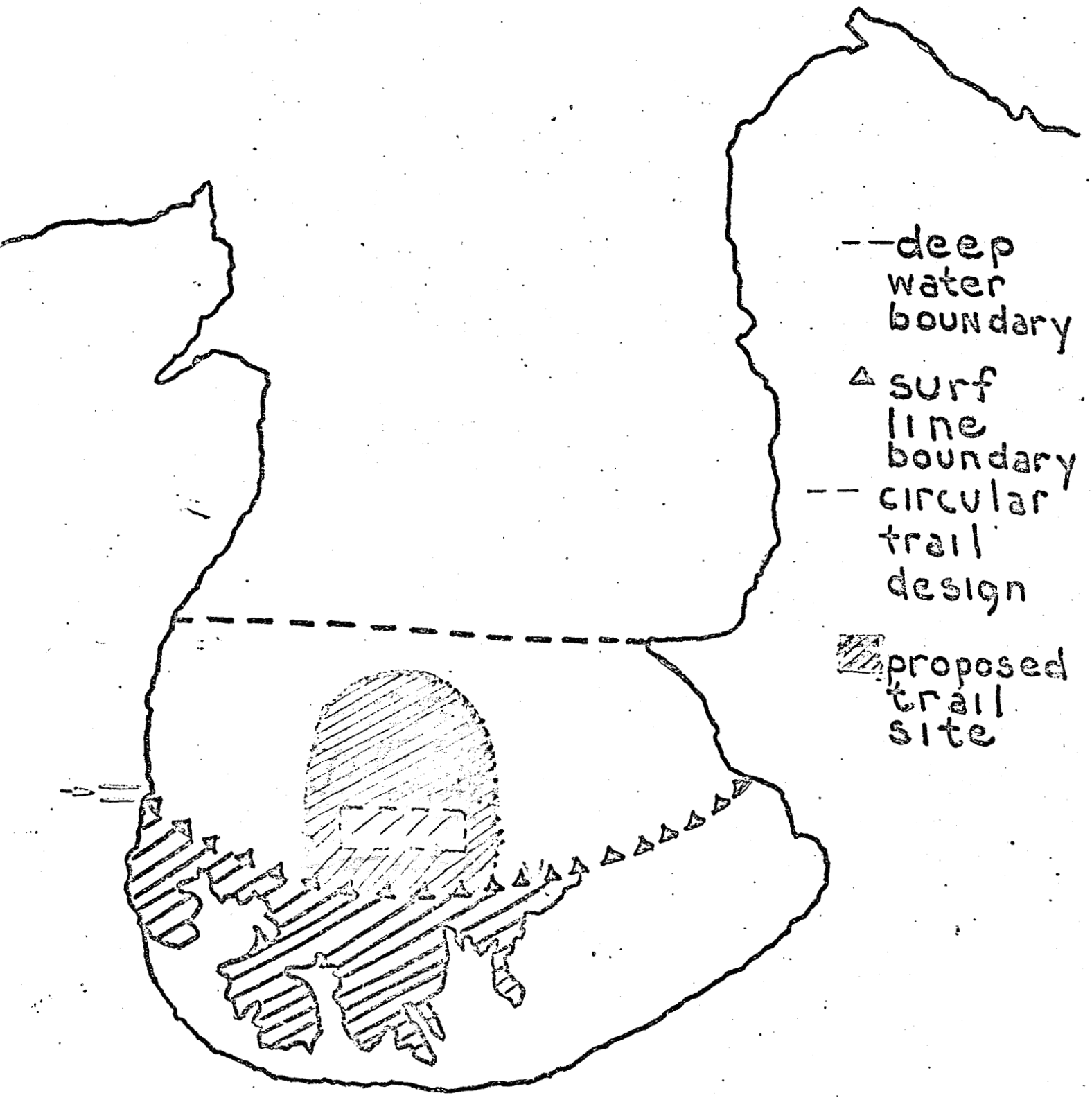
The work carried on by Hanauma Bay Project student personnel focuses upon:

1. Providing information about the physical layout, safety, and the presentation of display materials for the trail.
2. Supplying information concerning the identification, characteristics, and diversity of marine life within a specific portion of Hanauma Bay.

METHODS

The tactics concerning project objectives and the resulting suggestions are described in the paragraphs below and in their appendices.

THE HANAUMA BAY UNDERWATER TRAIL



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Physical Layout

The suggested physical scheme of the underwater trail requires the consideration of water safety factors, the position of marine life in the bay, and the most advantageous trail design to provide a convenient yet informative experience for snorkelers. Student personnel have been gathering this data from marine life experts, through surveys, and from information acquired by contacting personnel working at other underwater parks--John Pennekamp in Florida, and Buck Island in the Virgin Islands.

Resulting from this study a site has been proposed which lies just beyond the surf line. (This area is shown on the map on the next page. Appendix I should be consulted for data concerning the site selection.) Proposed underwater trail markers would cover only a part of the total area labeled as the proposed site. Underwater signs to go on the trail would best be placed in sight of each other, in water deeper than eight feet but shallower than fifteen feet, and arranged in a circular design. This circular design is outlined on the map on the next page. The overall length of the trail should be limited to approximately 250 to 300 feet. (See Appendix II concerning underwater sign placement and trail length.)

Safety

Students have approached the problems of safety by interviewing water safety experts, by talking to novices about problems they encounter, and by experimentation. From these sources a site has been recommended which provides a reasonably safe entry and exit. In considering entry and exit, however, there is no site that is 100 percent safe. (See Appendix III for entry site analysis.)

Rest buoy facilities along the trail are strongly recommended. The rest buoy system can be a highly effective lifesaver. Only three buoys need be used if they are placed strategically along the circular trail layout. (See Appendix IV for a sketch and explanation of this buoy system.)

Recommendations have been compiled concerning safety requirements for any tour of the trail. It is fully understood that the State cannot sponsor any type of guided tour; yet, special interest groups, as well as private individuals, should be advised as to their safety needs. (Refer to Appendix V for safety suggestions.)

Presentation

The presentation of marine life data to the general public is of paramount importance. Any description of underwater plaques should be limited to ten or twelve words. Simple sketches (not color pictures) should be used, and the printing should be in white with two inch lettering placed upon a dark background. The underwater plaques must be large enough to contain the sketch plus the lettering.

Some combination of heavy concrete base anchoring a fiber glass display covered with clear plexiglass will probably make viable materials for use in underwater trail plaques. (See Appendix VI for data on underwater material selection.)

Shore Display

Motile fish which are found in abundance can best be explained and further identified by a static shore display. There is also another large group of animals in the area--the invertebrates--whose life style prohibits their recognition anywhere except on a shore display. A combination of onshore displays and underwater plaques is recommended. (See Appendix VII

for data on Marine Life shore displays.)

Identification and Classification of Fauna

After study, some eighteen families of fish are offered as a minimum list to be indentified. This groups reads as follows:

Squirrel Fish	(Holocentridae)
Red Fish	(Apogonidae)
Weke	(Mullidae)
Truckfish	(Ostraciontidae)
Spiny Puffer	(Diodontidae)
Triggerfish	(Balistidae)
Scorpion Fish	(Scorpaedidae)
Tuna	(Scombridae)
Moorish Idol	(Zanclidae)
Parrot Fish	(Scaridae)
Wrasses	(Labridae)
Puhis	(Muraenidae)
Damsel Fish	(Pomacentrid)
Surgeon Fish	(Ancanthuridae)
Pipe Fish	(Syngnathidae)
Mullets	(Mugilidae)
Hawkfish	(Cirrhitidae)
Butterfly Fish	(Chaetodonitidae)

Identification should include the three prominent types of Hawaiian corals which are Pocillopora, Porites, and Montipora. Representative members of several invertebrate phyla are also important. These phyla and representative animals for each are as follows:

Echinodermata	
Heterocentrus	(slate pencil sea urchin)
Diadema	(wana)
Acanthaster Planci	(crown of thorns)
Ophiactis	(brittle star)
Annelida and Related Phyla	
Eurythoe	(fire worm)
Sipunculoidea	(peanut worm)
Dedentaria	(feather duster worm)
Molluska	
Conidae	(cone shell)
Mitra	(miter shell)
Cephalapoda	(tako)
Cypraea	(cowry shell)

Crustacea
- Paguridae (hermit crab)
- Xanthidae (crab)
- (banded shrimp)
- (snapping shrimp)

Miscellaneous
- Zoanthus confertus (soft coral)
- Demospongia (sponge)
- Tunicata (sea squirts)

- Coral itself ?

(See Appendix VIII explaining how suggested fish and invertebrate lists were compiled.)

Accompanying these identifications, a short, informative, and easily understandable description of each animal could be incorporated in the display structure. These descriptions would highlight interesting animal life found within the trail area. (See Appendix IX for sample descriptions.)

POTENTIAL

Once underwater trail plaques are placed and shore displays are erected the work of the project personnel will just be starting.

1. New students interested in acquiring marine skills that the project offers will have to be trained.

2. Students are eager to begin more extensive studies of marine life. These studies would look at coral growth rates and fish populations in Hanauma Bay's protected waters. Other students might study the impact of man's frequent visits in the trail area upon fish behavior.

3. Interested students propose to study safety within the bay in order to find out the reasons behind accidents there.

4. Many students are interested in observing life within the bay as training for other research projects in other areas.

5. Any students interested in managing public reactions to interpretive materials ? U of H Dr. Lewis Dept of Anthrop.

BENEFITS FOR THE STUDENT

This project is of great value to a student. An interested participant can gain a variety of water skills, such as running underwater transects or laying underwater grids. These important techinques are essential to many

occupations--underwater archeology and cartography, for example. Growth rates and population counts are very important studies for biologists, zoologists, and ecologists. Underwater transecting and underwater grid techniques determine the accuracy of such studies.

In addition to these techniques, a participating student will gain an "in the water" familiarity with his subject matter. Students will learn to work while surrounded by the gaudy, complex coral reef. Waves, surge and poor visibility will be practical problems with which students must deal while gathering information.

Students will be expected to communicate this information after its collection. Working between the State and the University, student personnel face a whole spectrum of communication and administrative problems. Exposure to these practical problems is a beneficial supplement to classroom studies and enhances a student's education. /good.

BENEFITS TO THE STATE

The people of the State of Hawaii and her visitors will soon be enjoying the third underwater trail in a United States park or territory. These people, we are hopeful, will gain a new and deeper appreciation of the complexity of life in our marine environment. This new awareness would go hand in hand with public based support for other needed marine studies.

The University of Hawaii is a reservoir of information concerning our marine surroundings. The Department of Land and Natural Resources is the State agency serving the recreational needs of the people of Hawaii. Interested students can work between these two institutions for the benefit of both by assisting in the implementation of those recommendations proposed by the Governor's Task Force on Oceanography concerning Hanauma Bay.

BUDGET

---Expenditures to date---	
Cost of display materials.....	$ 35.00
Cost of man hours at $2.00 per hour.....	$400.00
---Projected expenditures to June 1972---	
Man hours for installation of underwater trail markers.....	$350.00
Cost of air for Scuba.....	$100.00
Miscellaneous expenses for display materials.....	$ 50.00
Holding tanks, microscopes, lab supplies.....	need to be made available for student use

Appendix I -- Trail Site Selection

The proposed trail site was selected after considering many possible areas in the Bay. The area was chosen almost completely for ecological reasons, which are: (1) if the people using the Hanauma Bay trail stir up the bottom silt this will kill the coral along the trail site; and (2) if the people stand on the coral rock it is probable that they will kill the part they stand upon. Dr. Albert Banner, Professor of Zoology at the University of Hawaii, estimates that coral growth in the Bay is less than one centimeter per year. The coral, if abused by trail visitors, will be very slow reappearing.

Mr. Littlefield, Supervisory Ranger of the Buck Island National Monument in the Virgin Islands, suggests that the trail plaques all lie in water deeper than eight feet. For these reasons we have suggested a trail site which is not as easily accessible as others but which will last longer and encompass the same quality of marine life.

Appendix II -- Underwater Sign Placement and Trail Length

Experiments with basic scuba students show that 75 percent of the time they cannot follow one foot wide stripes on the bottom of a pool. The test students may wander 30-35 feet off target in a 25 yard pool. Yet, when told to swim to a visible object, it was found that they could do this effectively. Therefore, signs in sight of one another are suggested.

Mr. Littlefield, Supervisory Ranger at the Buck Island National Monument, suggested that underwater signs be placed in water deeper than eight or ten feet. (Refer to Appendix I, paragraph 2) Observation of basic scuba students has revealed that the comfortable submersion time while breath holding in a 12 foot swimming pool is somewhere between three to six seconds. This fact plus the knowledge that water clarity may at many times prohibit easy reading from any greater distance should establish 15 feet as a maximum for snorkelers.

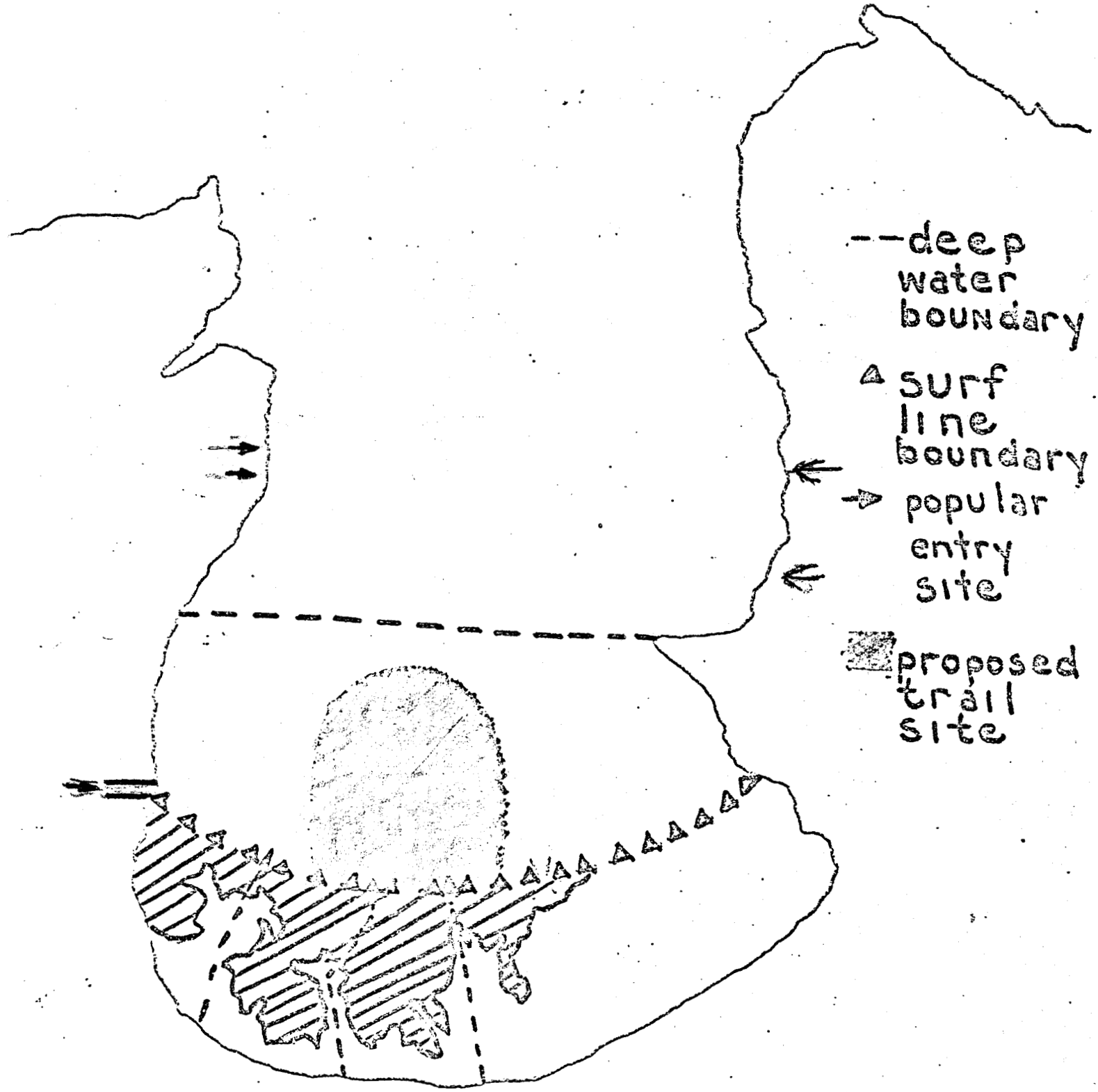
Mr. Littlefield suggests that the overall length of the trail be under 100 yards. We agree with this for a number of reasons. First, all the important features can be placed within a small area. Then, one must also consider the average snorkeler who may not be conditioned for any longer swim and without a wetsuit will probably not like to stay out any longer.

Appendix III -- Entry Analysis

The problem of a safe entry and exit at Hanauma Bay is a very difficult one. After consulting safety experts and through experimentation, the Hanauma Bay Project Group has compiled an analysis of popular entry and exit sites within the Bay. This analysis is offered on the map following this page. On the map the entry sites are presented in different colors. These colors correspond to varying degrees of safety, as follows:

- Green--safe most of the time, easily seen in the water.
- Blue--safe in calm weather, exit tricky for beginners.
- Orange--slippery and poor footing, dangerous during high wave action.
- Red--dangerous.

THE HANAUMA BAY UNDERWATER TRAIL



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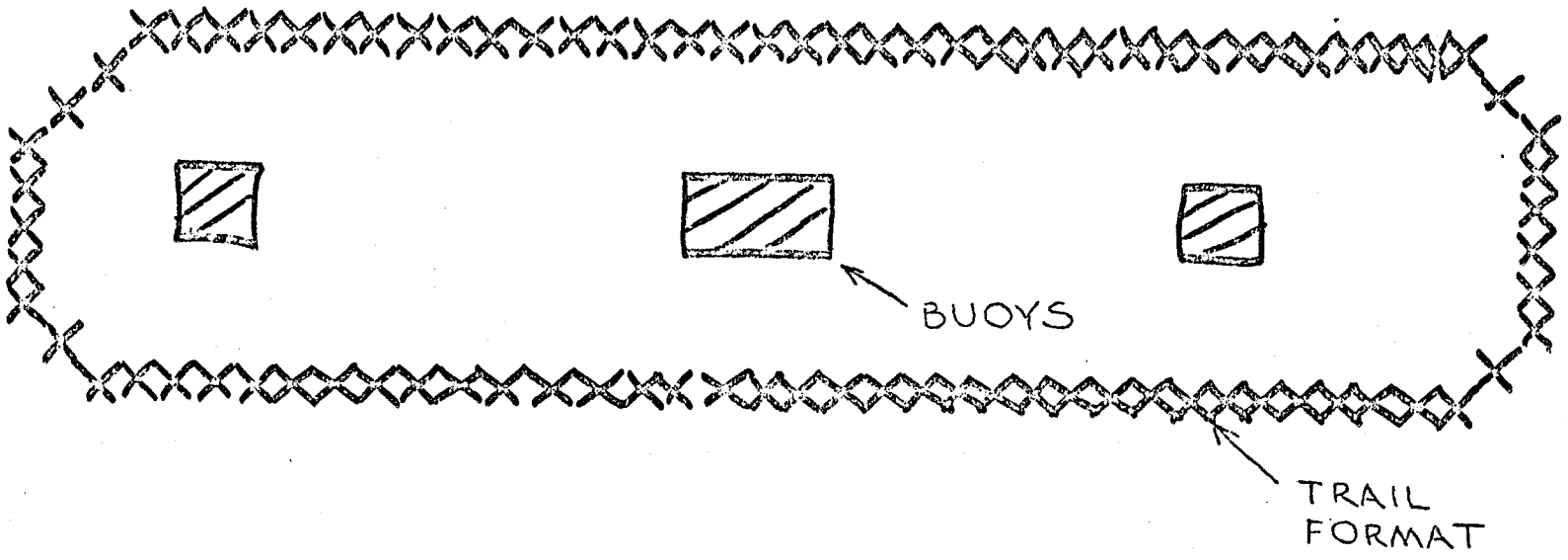
Appendix IV -- Buoy System

Water safety experts will testify that anyone, regardless of his health, swimming skill or experience is subject to panic, surprise, cramps, or unconsciousness in the water. The American Red Cross and our own lifeguards will readily remind us of how poorly the general public swims. For these reasons and anticipated problems, we have suggested that rest buoys be set within the trail site. In case of an emergency these buoys may save a life. A sketch of a possible buoy arrangement follows on the next page.

THIS SKETCH SHOWS HOW THE ENCLOSING DESIGN WOULD ENABLE A PERSON IN TROUBLE TO SWIM TO A NEARBY BOUY FROM ANYWHERE ON THE TRAIL. THIS SYSTEM USES ONLY 3 BUOYS.



Appendix V---Safety suggestions

1. The buddy system can be highly effective in saving lives provided that the person in trouble can be easily towed through the water.
2. An inflated life vest is a great aid for a person who is fatigued or being towed. The buoyancy also helps to stop panic in a victim who always fears sinking.
3. Adequately trained and confident people can drift at sea for days with only mask, fins, and snorkel.
4. Lifeguards, in Hawaii, already fly flags reporting water conditions at other beaches. This practice could be employed at Hanauma Bay to inform people of water conditions.

Putting these facts together gives a good indication as to the safety suggestions for people swimming along the Hanauma Bay underwater trail. These requirements would be: a buddy system, a life vest, confidence in their own use of mask, fins and a fair knowledge of water conditions.

The advantages of having safety personnel trained in rescue and first aid techniques for groups is that if an accident does occur help is immediately available.

A group planning ahead for an outing to Hanauma Bay could, if preadvised, make arrangements to obtain such personnel. Many people who will want to participate in this type of outing should not, due to health reasons. Groups must be made aware of their responsibility to verify the physical status of each group member.

Appendix VI---Underwater materials

Mr. Littlefield also suggested the use of a concrete base with a fiber glass display covered by plexiglass. Mr. Littlefield says these materials are easily maintained and attractive.

Sketches are recommended instead of color pictures. Due to the diffusion of light, underwater colors even at 8 feet will not be true and hence not as effective.

Ten or twelve words with two inch lettering are again suggestions that are made by Mr. Littlefield who has found them effective on the Buck Island Trail.

Appendix VII---Shore display data

Mr. Littlefield has assurred us that many people will associate any picture of fish underwater with the first fish they see. There are also a great number of important and interesting forms of life that live inside coral heads, algae, rocks or in the sand, that are almost impossible for the average snorkeler to find. To ignore these obscure animal groups is to ignore a large part of life within the bay. The public can never really appreciate Hanauma Bay fully until they can actually grasp the amount of life present there. Some type of shore display is needed which will portray this life.

The following presentation is suggested as a possible display showing the diversity of life in Hanauma Bay as well as teaching an ecological lesson:

The ability of man to change his environment can readily be seen. He can change a barren desert into a fruit bearing oasis. He also has the capacity to wreck havoc upon his surroundings. Granted, most of the man wrought harm dealt to Nature has been the result of ignorance. The public should be taught that Nature exists in a state of interdependence, each animal dependent upon another and to endanger one animal group is to endanger the whole system. This principal is shown beautifully by the animals living on the coral reef. A representative number of animal groups that are dependent upon the coral for food and/or shelter are presented below.

THE FISH

The fish are the reefs' most popular inhabitants. Either by cunning or speed they feed on virtually all other life forms on the reef (including other fish). Ironically, their eggs are found by hungry mollusks, sea ur-

chins, crabs and worms. Their hatched but small larvae are food for the coral itself, other fish, sea anemones and certain worms.

THE CRABS

One of the most elusive members of the coral community, this group is easily overlooked by most. Hiding deep within the coral they prey upon worms and mollusks. In turn, the octopus (a mollusk relative) loves crab meat as do many fish.

THE WORMS

These citizens were trained for food capture in two different schools. One teaches its members to bore through the coral rock and devour any other worms, or algae, or shrimp, or fish eggs in his path. The other school instructs its pupils to stay in one place and spread its many arms wide open. In this manner worms, like the feather duster, simply wait for food to swim into them.

THE STARFISH

The sea urchins and starfish crawl along the floor of the reef feeding on coral, fish eggs, algae, and smaller sea urchins and starfish. When the sea urchin is broken the fish quickly pick him apart. Starfish supply all types of animals with food in the form of their larva.

THE MOLLUSK

The sea shells and octopi like to hide in the coral during the day. They come out at night to crawl along the bottom feeding upon scraps. In the case of the octupus, crabs or other mollusks become food.

THE ALGAE

So drab that they are many times invisible to the naked eye these plants are responsible for secreting over 50% of the rock found on the reef.

The Coral ?

Appendix VIII---Animal lists

Data for identification of fish was gathered by means of transects and underwater grids. To determine species diversification a transect was run four times within the trail area. The fish which were sighted most often were then submitted on the identification list.

The transect consisted of a piece of rope 120 feet long which ran on the bottom of an area within the proposed trail site. Two persons on scuba then swam along both sides of this rope carrying underwater writing material. As they sighted different types of fish they wrote down the names. These names were sorted into different scientific families. After four of these transects were run, eighteen families of fish were chosen as those most frequently seen.

The representative group of invertebrate animals were chosen in much the same way except that underwater grids were used instead of transects. Underwater grids were made of weighted string 12 feet long by 12 feet wide and with cross commissures dividing the square into four equal parts. Once this grid was constructed, underwater divers on scuba took an assay of invertebrate life they could see within each grid square. This information was then sorted into scientific groups and the individuals found most frequently were chosen. After each common name, a scientific name was assigned. The scientific name of the fish or invertebrate animal was then found in Gosline and Brock's Hawaiian Fishes or in Edmondson's book, Hawaiian Reef, for positive identification.

This rock creates shelter for all of the other members of the community and for many of their larva. If this shelter perishes so must the animals it holds. Often, this essential component--shelter--is mistaken as dead and is destroyed. When this happens the reef system becomes a little poorer.

ENDING

Perhaps now it is easier to understand why the State prohibits the removal of any living thing from Hanauma Bay. And even more importantly, you have seen why all the rock and coral formations must be left just as they are.

Appendix IX---A sample fish description

BUTTERFLY FISH (Chaetodontidae)

These colorful fish are characterized by bold markings which make them very conspicuous in any surroundings. These bright patterns might include combinations of blue, orange, red, white and black but seem to lack green. Butterfly fish prefer remaining solitary rather than in schools and are found off the coral reef where they feed on small invertebrates and take refuge when approached. There are at least 16 different species in Hanauma Bay.

All closely resemble the picture above and measure approximately from 4 to 6 inches. (Of course, color pictures would be better.)

Appendix X---Curriculum Vitae of Principle Participants

ROLISON, Charles--project director; senior in biology

Experience: worked with Skin Diving Hawaii learning how to lay underwater grids and perform light salvage operations
water safety experience includes over 600 hours of class and ocean safety diving
experienced in identification techniques of Hawaiian invertebrates

Skills, hobbies: Scuba diving for five years
underwater photography
interested in populations in marine environments

Curriculum: invertebrate zoology, ecology

BARNETT, William--not attending school

Experience: knows underwater mapping
experienced in water safety due to class and ocean safety diving for Skin Diving Hawaii

Skills, hobbies: Scuba diving for 4 years
interested in underwater contruction

REDDING, Walter--sophomore in Marine Technology at Leeward Community College

Experience: former lifeguard at Bellows Air Force Base
water safety instructor

Skills, hobbies: familiar with local water, expecially southern shore
Scuba skills with interest in commercial diving

Curriculum: ocean technology at Leeward

ROLISON, James--high school student

Experience: involved with the preparation of the study

Skills, hobbies: NAUI certified
enjoys Hanuma Bay

STUART, James--junior in biology

Experience: worked with Dr. Arthur Reed, Associate Professor of Zoology, in water quality studies at Coconut Island
experience in defining geological formations

Skills, hobbies: NAUI certified
underwater photography

Curriculum: biology,chemistry

URASHIMA, Thomas

Experience: enrolled in Leeward's Marine Technology program
experience in limited commercial work

Skills, hobbies: knows how to read water conditions
interested in commercial diving

Curriculum: ocean technology at Leeward

WHITE, Norman--sophomore in chemistry

Experience: former lifeguard
worked as plexiglass fabricator
trained in underwater fish identification

Skills, hobbies: NAUI certified
interested in physical sciences

Curriculum: invertebrate zoology, chemistry

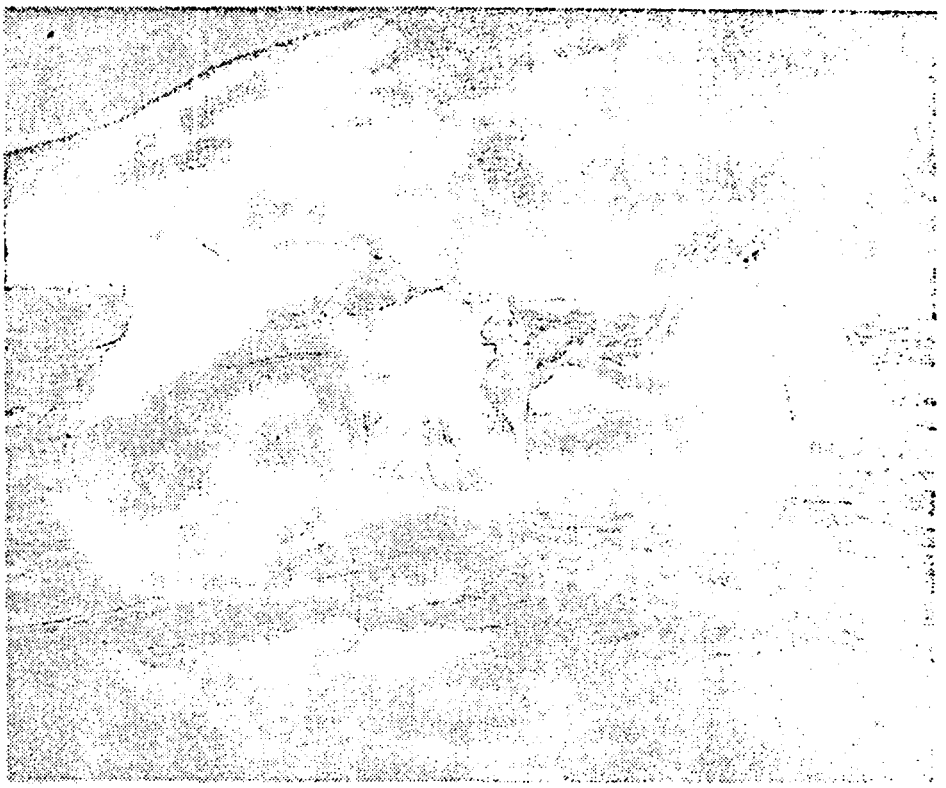
WITHROW, Reid--junior in zoology

Experience: former water survival instructor for the U.S. Marine Corps
trained in underwater identification of invertebrates

Skills, hobbies: NAUI certified
interested in diver impact on marine ecology

Curriculum: zoology, ecology

Hanauma snorkeling tour given



Instructor holds bag of garbage retrieved from reef floor.

If you ever wanted to snorkel but were afraid to try, or if you do snorkel and ever wondered what you were looking at, instructors are waiting to take you in tow at Hanauma Bay.

The City Department of Recreation has teamed up with oceanography students at the University of Hawaii to offer basic snorkeling and sea-ecology lessons to the adult public.

The weekend-only classes begin at 9:30 a.m. and 1 p.m. Saturdays and Sundays and cost $3.50 per person. Ocean recreation specialist Chuck Shipman said he hopes the classes will be expanded to include weekdays this summer.

THE CLASSES amount to a guided tour of Hanauma Bay, with three students in the University's marine options programs pointing out marine life and basic techniques in making the tides and currents of the bay work for a snorkeler instead of against him.

"The instructors are people who not only are water-safety trained but who also are knowledgeable and enthusiastic about the marine life," Shipman said.

The trio is made up of Charles Rolison and Reid Withrow, University seniors, and Art Challacombe, a graduate student. Each class is limited to four participants per instructor.

"WE WANT TO make more people aware of what this marine environment offers, to impress on them that they are the owners of the resource, and to teach them a little of what they can do for, or to it," Rolison said.

Even on an overcast day when underwater vision is reduced, Hanauma's waters offer a view of teeming fish life. Part of each class includes illustrated beachside discussions of the fish species to be seen.

The Department of Recreation provides basic snorkeling gear, but the public is encouraged to bring their own for better fittings.

More information can be obtained by calling recreation officials at City Hall.